

thrust is lower than rated takeoff augmented thrust, 5 of the 10-minute periods must be at rated maximum continuous augmented thrust; and

(iv) Six periods of 1 minute at rated takeoff augmented thrust each followed by 2 minutes, including acceleration and deceleration time, at idle thrust.

(2) *Simulated supersonic test.* Each run of the simulated supersonic test must be preceded by changing the inlet air temperature and pressure from that attained at subsonic condition to the temperature and pressure attained at supersonic velocity, and must be followed by a return to the temperature attained at subsonic condition. Thirty runs of 4 hours each must be made, consisting of—

(i) One period of 30 minutes at the thrust obtained with the power control lever set at the position for rated maximum continuous augmented thrust followed by 10 minutes at the thrust obtained with the power control lever set at the position for 90 percent of rated maximum continuous augmented thrust. The end of this period in the first five runs must be made with the induction air temperature at the limiting condition of transient overtemperature, but need not be repeated during the periods specified in paragraphs (g)(2)(ii) through (iv) of this section;

(ii) One period repeating the run specified in paragraph (g)(2)(i) of this section, except that it must be followed by 10 minutes at the thrust obtained with the power control lever set at the position for 80 percent of rated maximum continuous augmented thrust;

(iii) One period repeating the run specified in paragraph (g)(2)(i) of this section, except that it must be followed by 10 minutes at the thrust obtained with the power control lever set at the position for 60 percent of rated maximum continuous augmented thrust and then 10 minutes at not more than 15 percent of rated takeoff thrust;

(iv) One period repeating the runs specified in paragraphs (g)(2)(i) and (ii) of this section; and

(v) One period of 30 minutes with 25 of the runs made at the thrust obtained with the power control lever set at the position for rated maximum contin-

uous augmented thrust, each followed by idle thrust and with the remaining 5 runs at the thrust obtained with the power control lever set at the position for rated maximum continuous augmented thrust for 25 minutes each, followed by subsonic operation at not more than 15 percent or rated takeoff thrust and accelerated to rated takeoff thrust for 5 minutes using hot fuel.

(3) *Starts.* One hundred starts must be made, of which 25 starts must be preceded by an engine shutdown of at least 2 hours. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time before attempting a normal start. At least 10 starts must be normal restarts, each made no later than 15 minutes after engine shutdown. The starts may be made at any time, including the period of endurance testing.

[Doc. No. 3025, 29 FR 7453, June 10, 1964, as amended by Amdt. 33-3, 32 FR 3737, Mar. 4, 1967; Amdt. 33-6, 39 FR 35468, Oct. 1, 1974; Amdt. 33-10, 49 FR 6853, Feb. 23, 1984; Amdt. 33-12, 53 FR 34220, Sept. 2, 1988; Amdt. 33-18, 61 FR 31328, June 19, 1996]

§ 33.88 Engine overtemperature test.

(a) Each engine must run for 5 minutes at maximum permissible rpm with the gas temperature at least 75 °F (42 °C) higher than the maximum rating's steady-state operating limit, excluding maximum values of rpm and gas temperature associated with the 30-second OEI and 2-minute OEI ratings. Following this run, the turbine assembly must be within serviceable limits.

(b) Each engine for which 30-second OEI and 2-minute OEI ratings are desired, that does not incorporate a means to limit temperature, must be run for a period of 5 minutes at the maximum power-on rpm with the gas temperature at least 75 °F (42 °C) higher than the 30-second OEI rating operating limit. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the Administrator, to maintain the integrity of the turbine assembly.

(c) Each engine for which 30-second OEI and 2-minute OEI ratings are desired, that incorporates a means to limit temperature, must be run for a period of 4 minutes at the maximum power-on rpm with the gas temperature at least 35 °F (20 °C) higher than the maximum operating limit. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the Administrator, to maintain the integrity of the turbine assembly.

(d) A separate test vehicle may be used for each test condition.

[Doc. No. 26019, 61 FR 31329, June 19, 1996]

§ 33.89 Operation test.

(a) The operation test must include testing found necessary by the Administrator to demonstrate—

(1) Starting, idling, acceleration, overspeeding, ignition, functioning of the propeller (if the engine is designated to operate with a propeller);

(2) Compliance with the engine response requirements of § 33.73; and

(3) The minimum power or thrust response time to 95 percent rated takeoff power or thrust, from power lever positions representative of minimum idle and of minimum flight idle, starting from stabilized idle operation, under the following engine load conditions:

(i) No bleed air and power extraction for aircraft use.

(ii) Maximum allowable bleed air and power extraction for aircraft use.

(iii) An intermediate value for bleed air and power extraction representative of that which might be used as a maximum for aircraft during approach to a landing.

(4) If testing facilities are not available, the determination of power extraction required in paragraph (a)(3)(ii) and (iii) of this section may be accomplished through appropriate analytical means.

(b) The operation test must include all testing found necessary by the Administrator to demonstrate that the engine has safe operating characteristics

throughout its specified operating envelope.

[Amdt. 33-4, 36 FR 5493, Mar. 24, 1971, as amended by Amdt. 33-6, 39 FR 35469, Oct. 1, 1974; Amdt. 33-10, 49 FR 6853, Feb. 23, 1984]

§ 33.90 Initial maintenance inspection.

Each engine, except engines being type certificated through amendment of an existing type certificate or through supplemental type certification procedures, must undergo an approved test run that simulates the conditions in which the engine is expected to operate in service, including typical start-stop cycles, to establish when the initial maintenance inspection is required. The test run must be accomplished on an engine which substantially conforms to the final type design.

[Amdt. 33-10, 49 FR 6854, Feb. 23, 1984]

§ 33.91 Engine component tests.

(a) For those systems that cannot be adequately substantiated by endurance testing in accordance with the provisions of § 33.87, additional tests must be made to establish that components are able to function reliably in all normally anticipated flight and atmospheric conditions.

(b) Temperature limits must be established for those components that require temperature controlling provisions in the aircraft installation to assure satisfactory functioning, reliability, and durability.

(c) Each unpressurized hydraulic fluid tank may not fail or leak when subjected to maximum operating temperature and an internal pressure of 5 p.s.i., and each pressurized hydraulic fluid tank may not fail or leak when subjected to maximum operating temperature and an internal pressure not less than 5 p.s.i. plus the maximum operating pressure of the tank.

(d) For an engine type certificated for use in supersonic aircraft, the systems, safety devices, and external components that may fail because of operation at maximum and minimum operating temperatures must be identified and tested at maximum and minimum